EXHIBIT A

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Docket No.: APW-022
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Eiji Hashimoto *et al.*

Application No.: 10/656382 Confirmation No.: 8525

Filed: September 5, 2003 Art Unit: 2121

For: CONTROL SYSTEM FOR PLANT Examiner: S. Chang

AMENDMENT AND RESPONSE

MS Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Office Action mailed March 02, 2006 (Paper No. 20060219), Applicants submit the following Amendments and Remarks to place the application in condition for allowance.

In the Claims:

1. (Original) A control system for a plant, including a controller for controlling said plant based on a controlled object model which is obtained by modeling said plant,

said controlled object model being modeled using an input and an output of said plant which are sampled at intervals of a sampling period which is longer than a control period of said controller, and

the sampled input of said plant being a filtered control output which is obtained by filtering an output of said controller,

wherein said controller carries out a control process of said plant at intervals of the control period.

2. (Original) A control system according to claim 1, wherein said controller performs a feedback control of calculating the output of said controller to make the output of said plant coincide with a target value, said controller being capable of specifying a damping characteristic of a deviation between the output of said plant and the target value.

3. (Original) A control system according to claim 2, wherein said controller is a sliding mode controller.

4. (Original) A control system according to claim 3, wherein said sliding mode controller calculates a value of a switching function defined as a linear function of the deviation between the output of said plant and the target value, and a sampling time interval of the deviation which is used to calculate the value of the switching function is equal to the sampling period.

5. (Original) A control system according to claim 1, further including an identifier for identifying at least one model parameter of the controlled object model, wherein said controller calculates the output of said controller using the at least one model parameter identified by said identifier, and said identifier identifies the at least one model parameter at intervals of the sampling period, using the filtered output of said controller.

6. (Original) A control system according to claim 1, wherein said plant includes a throttle valve of an internal combustion engine and a throttle valve actuating device having an actuator for actuating said throttle valve, and said controller calculates a parameter for determining a control input to be applied to said throttle valve actuating device to make an opening of said throttle valve coincide with a target opening.

7. (Original) A control system for a plant, comprising:

an identifier for identifying at least one model parameter of a controlled object model which is obtained by modeling said plant;

a controller for controlling said plant using the at least one model parameter identified by said identifier, said controller carrying out a control process of said plant at intervals of a control period; and

a filter for filtering an output of said controller,

wherein said controlled object model is modeled using an input and an output of said plant which are sampled at intervals of a sampling period which is longer than the control period of said controller, and said identifier identifies the at least one model parameter based on an output of said filter and the output of said plant.

8. (Original) A control method for a plant, comprising the steps of:

a) modeling said plant using an input and an output of said plant which are sampled at intervals of a sampling period, to obtain a controlled object model of said plant; and

b) carrying out a control process of said plant based on the controlled object model at intervals of a control period which is shorter than the sampling period, to calculate a control output applied to said plant,

wherein the sampled input of said plant is a filtered control output which is obtained by filtering the control output.

9. (Original) A control method according to claim 8, wherein a feedback control of calculating the control output is performed to make the output of said plant coincide with a target value, and a damping characteristic of a deviation between the output of said plant and the target value being specifiable.

10. (Original) A control method according to claim 9, wherein the feedback control is a sliding mode control.

11. (Original) A control method according to claim 10, further including the step of calculating a value of a switching function defined as a linear function of the deviation between the output of said plant and the target value, wherein a sampling time interval of the deviation which is used to calculate the value of the switching function is equal to the sampling period.

12. (Original) A control method according to claim 8, further including the step of identifying at least one model parameter of the controlled object model, wherein the control output is calculated using the at least one identified model parameter, and the at least one model parameter is identified at intervals of the sampling period, using the filtered control output.

13. (Original) A control method according to claim 8, wherein said plant includes a throttle valve of an internal combustion engine and a throttle valve actuating device having an actuator for actuating said throttle valve, and a parameter for determining a control input to be applied to said throttle valve actuating device is calculated to make an opening of said throttle valve coincide with a target opening.

14. (Original) A control method for a plant, comprising the steps of:

a) identifying at least one model parameter of a controlled object model which is obtained by modeling said plant;

b) carrying out a control process of said plant using the at least one identified model parameter at intervals of a control period, to calculate a control output applied to said plant,; and

c) filtering the control output,

wherein said controlled object model is modeled using an input and an output of said plant which are sampled at intervals of a sampling period which is longer than the control period, and the at least one model parameter is identified based on the filtered control output and the output of said plant.

15. (Currently Amended) A computer program <u>embodied on a computer readable medium</u> for causing a computer to carry out a control method for a plant, comprising the steps of:

a) identifying at least one model parameter of a controlled object model which is obtained by modeling said plant;

b) carrying out a control process of said plant using the at least one identified model parameter at intervals of a control period, to calculate a control output applied to said plant,; and

c) filtering the control output,

wherein said controlled object model is modeled using an input and an output of said plant which are sampled at intervals of a sampling period which is longer than the control period, and the at least one model parameter is identified based on the filtered control output and the output of said plant.

16. (Currently Amended) A computer program embodied on a computer readable medium according to claim 15, wherein a feedback control of calculating the control output is performed to make the output of said plant coincide with a target value, and a damping characteristic of a deviation between the output of said plant and the target value being specifiable.

17. (Currently Amended) A computer program embodied on a computer readable medium according to claim 16, wherein the feedback control is a sliding mode control.

18. (Currently Amended) A computer program embodied on a computer readable medium according to claim 17, further including the step of calculating a value of a switching function defined as a linear function of the deviation between the output of said plant and the target value, wherein a sampling time interval of the deviation which is used to calculate the value of the switching function is equal to the sampling period.

19. (Currently Amended) A computer program embodied on a computer readable medium according to claim 15, further including the step of identifying at least one model parameter of the controlled object model, wherein the control output is calculated using the at least one identified model parameter, and the at least one model parameter is identified at intervals of the sampling period, using the filtered control output.

20. (Currently Amended) A computer program embodied on a computer readable medium according to claim 15, wherein said plant includes a throttle valve of an internal combustion

engine and a throttle valve actuating device having an actuator for actuating said throttle valve, and a parameter for determining a control input to be applied to said throttle valve actuating device is calculated to make an opening of said throttle valve coincide with a target opening.

REMARKS

Now in the application are claims 1-20, of which claims 1, 7, 8, 14 and 15 are independent. The forgoing amendments amend claims 15-20 to address matters of form and are not meant to address any prior art rejection. The following comments address all the stated grounds for rejection and place the presently claims as identified above, in condition for allowance. Applicants respectfully urge the Examiner to reconsider the outstanding rejections and to pass the application to allowance in view of the remarks set forth below.

Claim Amendments

The preamble of claims 15-20 are amended to reflect the claimed computer program is embodied on a computer readable medium. No new matter is added and no new issues are raised, therefore no new search is required.

DOUBLE PATENTING REJECTION

In the Office Action, claims 1-20 are provisionally rejected under the judicially created doctrine of obvious-type double patenting as being unpatentable over claims 1-16 of copending Application No. 10/349,538 in view of U.S. Patent No. 6,082,099. In response to the provisional rejections, Applicants submit a terminal disclaimer in compliance with 37 CFR 1.321 (b) and (c).

In view of the terminal disclaimer, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

CLAIM REJECTIONS UNDER 35 U.S.C. §102(b)

Claims 1-20 stand rejected 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 6,082,099 to Yasui, *et al.* (hereinafter "Yasui"). Applicants respectfully traverse this rejection, and contend that the Yasui reference does not anticipate Claims 1-20.

Applicants' invention provides control systems for a plant, control methods for a plant, and computer programs embodied on a computer readable medium to perform control methods for a plant. More specifically, Applicants' inventions provides a control system for a plant that

includes, amongst other features, a controller for controlling the plant based on a controlled object model which is obtained by modeling the plant. The controlled object model is modeled using an input and an output of the plant which are sampled at intervals of a sampling period which is longer than a control period of the controller. The sampled input of the plant is a filtered control output which is obtained by filtering an output of the controller. The controller carries out a control process of the plant at intervals of the control period.

With this configuration, function and operation, the plant is controlled based on the controlled object model which is modeled using the input and the output of the plant which are sampled at intervals of the sampling period that is longer than the control period of the controller. Therefore, when the control process is carried out at intervals of a control period which is shorter than a period corresponding to the operating frequency range of the plant, in order to shorten the dead time and compensate for dynamic characteristics such as the friction characteristics, the dynamic characteristics of the controlled object model can be accurately approximated to the actual dynamic characteristics of the plant. Further, since the control period of the controller is shorter than the sampling period of the input and the output of the plant, the output of the controller, i.e., the input of the plant, normally changes at intervals of a period corresponding to the control period. Therefore, by performing the filtering process that attenuates high frequency components of the output of the controller and setting the filtered output of the controller as the sampled input of the plant, variations in the input applied to the controlled object model, which correspond to the relatively short control period, can be effectively suppressed. As a result, the accuracy of the controlled object model becomes higher (the modeling error is reduced) so that the controllability of the plant can be improved. The modeling error is a difference between the actual characteristics of the controlled object and the characteristics of the controlled object model. The Yasui reference does not disclose such features, and therefore, does not anticipate Claims 1-20, as amended.

The Yasui reference does not anticipate Claims 1-20, as amended. Yasui is directed to an air fuel ratio control system for an internal combustion engine, in which a target air fuel ratio is set according to an output of an oxygen concentration sensor provided downstream of a catalyst that is mounted on an exhaust system of an engine. The Yasui reference further discloses two controllers. The first is a controller for performing the

Yasui reference is an output of the plant. Therefore, the Yasui reference does not disclose or suggest the feature of the present invention that the sampled input of the plant is a filtered control output which is obtained by filtering the output of the controller.

For at least these reasons, the Yasui reference does not anticipate claims 1-20, as amended. Accordingly, Applicants respectfully request the Examiner to reconsider and withdraw the rejection of Claims 1-20, as amended under 35 U.S.C. §102(b).

CONCLUSION

In view of the above Remarks, applicants believe the pending application is in condition for allowance.

Dated: June 2, 2006

Respectfully submitted,

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